

Opening address

This year, the 32^{èmes} Journées des Laboratoires Associés de Radiophysique et de Dosimétrie (L.A.R.D.) were hosted and organized by the Centre d'Etudes Nucléaires de Bordeaux Gradignan (CENBG), a public research laboratory of CNRS/IN2P3 and Université of Bordeaux.

This two days workshop, organized for the members of the L.A.R.D., gave them the opportunity to review their most recent research in radio-physics, radio biology and dosimetry, allowing in particular the young researchers (PhD students and post-doc) to present their work and to share their knowledge in a friendly and open environment.

Eleven oral presentations were given during these days, they covered a wide range of topics, among them dosimetry, radiophysics, radiobiology, radiation protection and simulation, as well as the industrial and biomedical applications of radiation. Five papers are included in this proceeding, four correspond to oral presentations given during the "32^{èmes} journées des L.A.R.D.", one was presented during a previous "Journées des L.A.R.D.". The presentations themselves can be found at <http://www.asso-lard.eu/>.

The "Prix Daniel Blanc" is awarded by the L.A.R.D. committee every years to honor a particularly interesting PhD thesis work having given rise to numerous publications. This year, this prize was awarded to Alice Petitguillaume for her PhD thesis entitled "Dosimétrie Monte Carlo personnalisée pour la planification et l'évaluation des traitements de radiothérapie interne : développement et application à la radiothérapie interne sélective (SIRT)". This work was completed at the Institut de Radioprotection et de Sureté Nucléaire », the IRSN.

Organization committee:

Sébastien Incerti (CENBG/IN2P3/CNRS/U. Bordeaux) (organisateur local)

Marie-Claude Bordage (INSERM/U. Paul Sabatier, Toulouse)

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The Centre d'Etudes Nucléaires de Bordeaux-Gradignan (CENBG)

The CENBG staff was honored to host the 32^{èmes} Journées des Laboratoires Associés de Radiophysique et de Dosimétrie. CENBG is a joint research unit of the CNRS (French National Center for Scientific Research) and the University of Bordeaux. It gathers together a multidisciplinary community of physicists, chemists and biologists who study the structure of matter, from the smallest scales to cosmic particle accelerators. The laboratory conducts research in nuclear and particle physics with their connections to lasers, nuclear energy, health, and the environment. Technical support groups develop state-of-the-art facilities and advanced technologies, creating innovative research instruments and confronting tomorrow's challenges.

Research undertaken at CENBG is focused on five main topics:

- **structure of atomic nuclei:** experimental and theoretical studies of nuclear structure and fundamental interactions; behavior at the limits of stability; rare disintegration channels
- **astroparticle and neutrino physics:** cosmic particle acceleration mechanisms producing gamma-ray emission of pulsars, supernova remnants and active galactic nuclei; the search for a new type of radioactivity: the neutrinoless double-beta decay, to determine the nature of the neutrino
- **nuclear physics and power lasers:** characterizing particle sources generated by lasers; studies of nuclear properties in plasmas
- **nuclear energy, radioactivity and environment:** neutron data applied to 4th generation reactors and environmental impact; waste transmutation; deep underground storage and interactions with micro-organisms
- **health and environment:** health effects of physical-chemical contaminants; mechanisms of action of ionizing radiation, metals, and nanoparticles interactions with living organisms; application to innovative cancer therapies

These research activities and technical developments take place within a large number of scientific projects and collaborations. International collaborations include nuclear physics (SPIRAL2, FAIR), neutrino physics (SuperNEMO) and gamma-ray astrophysics (Fermi, HESS, CTA). Several initiatives and projects are supported by European FP7: energy (ANDES, CHANDA, F-BRIDGE), nuclear physics (SPIRAL2 PP, EURISOL), biology (SPRITE). We host multinational teams on technical facilities (SPIRIT, ERINDA, SPRITE) and participate to long-term programs (ERC P-WIND, ESA GEANT4-DNA). National programs include GDR MIZB, TOXNUC, CNRS MI challenges (NEEDS, NANO) and Becquerel network of radioactivity measurement facilities. Locally, CENBG is part of COTE and LAPHIA LabEx structural initiatives, IOPRA program for cancer treatment, Equipex programs (PETAL+, DESIR) and is in charge of instrumental developments for IRSN at Cadarache.

CENBG equipment also includes three state-of-the-art technical facilities which serve the laboratory's groups and visiting European teams. The **AIFIRA** irradiation platform is dedicated to materials analysis and characterization, 2D/3D imaging, controlled irradiation for biological experimentation, environmental studies, materials analysis and cultural heritage. It is equipped with an accelerator that provides 3.5 MeV light ion beams in vacuum or air, focused to sub-micron spots, as well as monochromatic neutron beams. Beneath significant shielding from cosmic rays, the very low noise spectrometers of the **PRISNA** facility measure gamma isotopes at rates 10,000 times lower than natural radioactivity. Applications range from neutrino physics and archeological studies to wine data and product traceability. Finally, the **PIAGARA** facility offers ultra-high sensitivity (a few thousand atoms) mass spectrometry for rare gas analysis. Applications include marine and land-based geochemistry, meteorite analysis, and $^{81,85}\text{Kr}$ as an environmental and nuclear industrial marker.

In summary, CENBG domains of expertise range from experimental and theoretical fundamental physics, to analytical chemistry, as well as molecular and cellular biology methodology. Original instruments are developed to measure subtle physical and chemical effects. The CENBG mechanical design, electronics, computer science, and instrumentation groups work within national and international networks, developing particle detectors, accelerators, and high-energy telescopes.

In addition, CENBG university, scientific, and engineering members of staff teach in the nuclear physics BSc, Masters, and vocational programs (M.Sc. in nuclear instrumentation and GTI2N). Many interns acquire *in situ* training at CENBG each year.

Finally, two technology transfer units make CENBG services available to industry: **ARCANE** support materials analysis with ion beams and **PRISNA-Prestations** provides low-level radioactive isotope sample measurements.

*Philippe Moretto,
director of CENBG*